ESA section 7 Consultation Number F/NWR/2002/00693

**National Marine Fisheries Service**
**Endangered Species Act (ESA) Section 7 Consultation Biological Opinion**
**and Magnuson–Stevens Act Essential Fish Habitat Consultation**

**Action Agencies:**
The National Marine Fisheries Service (NOAA Fisheries)
The Bonneville Power Administration (BPA)
The U.S. Fish and Wildlife Service (USFWS)
The U.S. Geological Survey (USGS)
The U.S. Forest Service (USFS)
The U.S. Army Corps of Engineers (USACE)

**Species/ESUs Affected:**
Threatened Lower Columbia River (LCR) chinook salmon (*Oncorhynchus tshawytscha*)
Threatened LCR steelhead (*O. mykiss)*
Threatened Columbia River (CR) chum salmon (*O. keta)*
Threatened Upper Willamette River (UWR) chinook salmon (*O. tshawytscha*)

**Activities Considered:**
1. Issuance of Permit No. 1135 to the USGS.
2. Issuance of Permit No. 1322 to NOAA Fisheries Northwest Fisheries Science Center (NWFSC).
3. Issuance of Permit No. 1366 to Oregon State University (OSU).
4. Issuance of Permit No. 1383 to the USGS.
5. Issuance of Permit No. 1386 to the Washington Department of Ecology (WDOE).

**Consultation Conducted by:**
The Protected Resources Division (PRD), Northwest Region, NOAA Fisheries
Consultation Number F/NWR/2002/00693

**Approved by:**
for D. Robert Lohn, Regional Administrator

Date: August 12, 2002 (Expires on: December 31, 2006)

This Biological Opinion (Opinion) constitutes NOAA Fisheries' review of five ESA section 10(a)(1)(A) permit applications affecting LCR chinook salmon, LCR steelhead, CR chum salmon, and UWR chinook salmon. It has been prepared in accordance with section 7 of the ESA of 1973, as amended (16 U.S.C. 1531 et seq.). It is based on information provided in the applications for the proposed permits, published and unpublished scientific information on the biology and ecology of threatened salmonids in the action area, and other sources of information. A complete administrative record of this consultation is on file with the PRD in Portland, Oregon.

## CONSULTATION HISTORY

NOAA Fisheries proposes to issue three new permits and two modifications to existing permits and thereby authorize the permit holders to conduct scientific research studies on threatened LCR chinook salmon, threatened LCR steelhead, threatened CR chum salmon, and threatened UWR chinook salmon. The Northwest Region's PRD decided to group these actions into a single consultation pursuant to 50 CFR 402.14(c) because they are similar in nature, occur in similar locations, and will affect the same threatened species. This Opinion constitutes formal consultation and an analysis of effects solely for the four threatened species listed above. Some of the proposed research activities may affect ESA-listed species under the jurisdiction of the USFWS (e.g., threatened bull trout (*Salvelinus confluentus*)). Permit applicants are required to obtain a take authorization from the USFWS if ESA-listed species under its jurisdiction are expected to be encountered. The consultation histories for each of the permits are summarized below.

*Permit No. 1135—for the USGS.*

On February 4, 2002, the PRD received a request from the USGS in Cook, Washington, to modify Permit 1135 to increase take of adult and juvenile LCR steelhead associated with the research. The PRD subsequently asked for clarification on the ESA status of chinook salmon in the Wind River and received additional information on May 29, 2002. Take of adult fish are limited to observation by snorkeling.

*Permit No. 1322—for the NWFSC.*

On March 5, 2002, the PRD received a request from the NWFSC in Seattle, Washington, to modify Permit 1322 to include transfer of fish tissue samples and to increase take of juvenile LCR chinook salmon and UWR chinook salmon. The PRD subsequently asked for additional information on the numbers and types of fish to be taken and received revised take numbers on several dates in May and June 2002.

*Permit No. 1366—for the OSU.*

On January 25, 2002, the PRD received a permit application from the OSU Oregon Cooperative Fish and Wildlife Research Unit (OCFWRU) in Corvallis, Oregon. The work will be conducted in cooperation with the Idaho Cooperative Fish and Wildlife Research Unit (ICFWRU). The PRD subsequently received updated take tables on February 12, 2002 and May 20, 2002.

*Permit No. 1383—for the USGS.*

On March 27, 2002, the PRD received a permit application from the USGS in Cook, Washington. The PRD subsequently received two updated applications on May 10, 2002 and May 16, 2002, to clarify the numbers and types of fish requested to be taken.

*Permit No. 1386—for the WDOE.*

On May 13, 2002, the PRD received a permit application from the WDOE in Olympia, Washington. The PRD determined the application to be complete on May 16, 2002, after additional information on the actions was received.

On February 20, 2002, NOAA Fisheries completed a formal consultation [F/NWR/1998/01377] on studies affecting these species. This consultation is for the newly requested takes since that consultation was completed.

## DESCRIPTION OF THE PROPOSED ACTIONS

### Common Elements among the Proposed Actions

NOAA Fisheries proposes that all five of the permit actions considered in this Opinion should be in effect for five years; that is they would expire on December 31, 2006. Also, in all instances where a permit holder does not expect to indirectly kill any listed fish during the course of his or her work, the indirect lethal take figure has been set at one. The reason is that, on occasion, unforseen circumstances can arise and NOAA Fisheries has determined it is best in these instances to include modest overestimates of expected take. By doing this, NOAA Fisheries gives researchers enough flexibility to make in-season research protocol adjustments in response to annual fluctuations in environmental conditions such as water flows, larger than expected run sizes, etc. without having to suspend research activities because the expected take was exceeded. Also, high take estimates are useful for NOAA Fisheries to conservatively analyze the effects of the actions, as it allows accidents that could cause higher-than-expected take to be included in the analysis.

Research permits list general and special conditions to be followed before, during, and after the research activities are conducted. These conditions are intended to: (a) manage the interaction between scientists and ESA-listed salmonids by requiring that research activities be coordinated among permit holders and between permit holders and NOAA Fisheries, (b) require measures to minimize impacts on target species, and (c) report to NOAA Fisheries information on the effect the permitted activities have on the species of concern. The following conditions are common to all of the permits. In all cases, the permit holder must:

1. Anesthetize each ESA-listed fish that is handled out-of-water. Anesthetized fish must be allowed to recover (e.g., in a recovery tank) before being released. Fish that are simply counted must remain in water and do not need to be anesthetized.

2. Handle each ESA-listed fish with extreme care and keep them in water to the maximum extent possible during sampling and processing procedures. The holding units must contain adequate amounts of well-circulated water. When using gear that captures a mix of species, ESA-listed fish must be processed first to minimize the duration of handling stress. The transfer of ESA-listed fish must be conducted using a sanctuary net to prevent the added stress of an out-of-water transfer.

3. Stop handling ESA-listed juvenile fish if the water temperature exceeds 70 degrees Fahrenheit at the capture site. Under these conditions, ESA-listed fish may only be identified and counted.

4. Use a sterilized needle for each individual injection when using a passive integrated transponder tag (PIT-tag) to mark ESA-listed fish. This is done to minimize the transfer of pathogens between fish.

5. Notify NOAA Fisheries in advance of any changes in sampling locations or research protocols, and obtain approval before implementing those changes.

6. Not intentionally kill (or cause to be killed) any ESA-listed species authorized to be taken by the permit, unless the permit allows for lethal take of the ESA-listed species.

7. Exercise due caution during spawning ground surveys to avoid disturbing, disrupting, or harassing ESA-listed adult salmonids when they are spawning. Whenever possible, walking in the stream must be avoided—especially in areas where ESA-listed salmonids are likely to spawn.

8. Use visual observation protocols instead of intrusive sampling methods whenever possible. This is especially appropriate when merely ascertaining whether anadromous fish are present. Snorkeling and streamside surveys will replace electrofishing procedures whenever possible.

9. Comply with NOAA Fisheries' backpack electrofishing guidelines when using backpack electroshocking equipment to collect ESA-listed fish.

10. Report to NOAA Fisheries whenever the authorized level of take is exceeded or if circumstances indicate that such an event is imminent. Notification should be made as soon as possible, but no later than two days after the authorized level of take is exceeded. Researchers must then submit a detailed written report. Pending review of these circumstances, NOAA Fisheries may suspend research activities or reinitiate consultation before allowing research activities to continue.

11. Submit to NOAA Fisheries a post-season report summarizing the results of the research. The report must include a detailed description of activities, the total number of fish taken at each location, an estimate of the number of ESA-listed fish taken at each location, the manner of take, the dates/locations of take, and a discussion of the degree to which the research goals were met.

Additional permit conditions specific to each of the proposed research are included in the descriptions of the respective permits.

Some of the activities identified in the proposed permit actions will be funded by several Federal agencies including NOAA Fisheries, the BPA, the USACE, the USGS, the USFWS, and the USFS. Although these agencies are also responsible for complying with section 7 of the ESA because they are funding activities that may affect ESA-listed species or their habitats, this consultation considers the activities they propose to fund and will fulfill their section 7 consultation requirement.

Finally, NOAA Fisheries will monitor actual annual takes of ESA-listed fish species associated with scientific research activities (as provided to NOAA Fisheries in annual reports or by other means) and shall adjust annual permitted take levels if they are deemed to be excessive or if cumulative take levels are determined to operate to the disadvantage of the ESA-listed species.

**The Individual Permits**

The ESA describes take to mean to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Each permit action requests to take the threatened species that are the subject of this Opinion. Activities proposed in the permit actions have been classified into the following categories (per the application instructions) and are defined as follows:

1. Observe/harass;
2. Collect for transport (including rescue/salvage);
3. Capture, handle, and release;
4. Capture, handle, tag, mark, tissue sample, and/or other invasive procedure, and release;
5. Direct lethal take (sacrifice);
6. Indirect lethal take (indirect mortality);
7. Removal (e.g., for broodstock collection); and
8. Other take (any take not described above).

Many of the permit requests described in the following pages seek to take other listed salmonids along with those addressed in this Opinion (e.g., Snake River spring/summer chinook salmon). The effects of taking those other species are described in other biological opinions and are not relevant to this consultation. Therefore, only those portions of the proposed research activities that would affect LCR chinook salmon, LCR steelhead, CR chum salmon, and UWR chinook salmon are discussed here.

*Permit 1135*

A modification to Permit 1135 (modification 1) would authorize the USGS to annually take adult and juvenile LCR steelhead associated with research designed to provide information on the survival rates, growth rates, habitat use, population densities, fish health, and life-history diversity of steelhead in the Wind River Basin of southern Washington. The research will benefit the listed species by providing information that will assist state, tribal, and Federal managers in their effort to restore LCR steelhead populations and their habitats in the Wind River Basin. The USGS proposes to capture (using backpack electrofishing), anesthetize, sample for biological data, tag, and release juvenile fish. The USGS requests take for any fish killed as an indirect result of the research. The USGS also proposes to kill juvenile fish for isotope work and disease profiling. Mortalities would be sent to the U.S. Fish and Wildlife Service's Lower Columbia River Fish Health Center. An unquantifiable number of adult and juvenile LCR steelhead will be observed via snorkeling during habitat surveys.

*Permit 1322*

A modification to Permit 1322 (modification 1) would authorize the NWFSC to annually take juvenile LCR chinook salmon, CR chum salmon, and UWR chinook salmon associated with research in the Lower Columbia River estuary. The purposes of the study are to: (1) determine the presence and abundance of fall and spring chinook salmon, coho salmon, and chum salmon in the estuary and Lower Columbia River; (2) determine the relationship between juvenile salmon and Lower Columbia River estuarine habitat; and (3) obtain information about flow change, sediment input, and habitat availability for the development a bio-physical model. The study would benefit listed salmonids by serving as the basis for estuarine restoration and preservation plans for endangered salmonid stocks. The NWFSC proposes to place beach seines at eight sampling sites near the Astoria Bridge and trapnets in four sites in Cathlamet Bay. The NWFSC proposes to capture, anesthetize, scan for tags, measure, weigh, and release juvenile salmonids. Listed fish at each of the twelve sampling sites would be killed each month for tissue sampling. The NWFSC also requests take for mortalities that may occur as an indirect result of the research; any indirect mortalities would be used in place of the intentional lethal takes.

*Permit 1366*

Permit 1366 would authorize the OSU/OCFWRU and ICFWRU to annually take juvenile LCR chinook salmon associated with scientific research to be conducted at Lower Granite Dam on the lower Snake River and McNary and Bonneville Dams on the lower Columbia River. The purpose of the research is to compare biological and physiological indices of wild and hatchery juvenile fish exposed to stress from bypass, collection, and transportation activities at the dams. The research is intended to improve the survival of the ESA-listed fish species at the dams by providing information that will be used to determine the effects of the manmade structures and associated management activities on the outmigrating salmonids. OSU proposes to capture (using lift nets or dipnets) or acquire from Smolt Monitoring Program or NOAA Fisheries personnel, sample for biological information, tag with radiotransmitters, and release juvenile salmonids. OSU requests intentional lethal takes of LCR chinook salmon associated with the research.

*Permit 1383*

Permit 1383 would authorize the USGS to annually take adult and juvenile LCR chinook salmon, LCR steelhead, and CR chum salmon associated with research designed to investigate the current distribution and population status of coastal cutthroat trout above Bonneville Dam on the lower Columbia River. The research will provide information on sympatric relationships between anadromous species and coastal cutthroat trout and the status of naturally reproducing populations of coastal cutthroat trout in this area as well as provide baseline population abundance and status information to various entities that manage salmonids, including Federal and state resource managers, conservation groups, and Native American tribes. The USGS proposes to observe by snorkeling adult and juvenile salmon and steelhead at selected sites in the basin. The USGS also proposes to capture (using electrofishing, netting, trapping, and angling), anesthetize, handle, and release juvenile fish. The USGS also requests take for mortalities that may occur as an indirect result of the research. Mortalities would be sent to the U.S. Fish and Wildlife Service's Lower Columbia River Fish Health Center for disease profiling.

*Permit 1386*

Permit 1386 would authorize the WDOE to annually take adult and juvenile life stages of all of the ESA-listed anadromous fish ESUs in Washington associated with a research project proposed to occur in various streams throughout the state. The objectives of the research are to investigate the occurrence and monitor the concentrations of toxic contaminants in edible fish tissue and the freshwater environments of the state as part of the Washington State Toxics Monitoring Program. The proposed project responds in part to the state's responsibility for protecting residents from the health risks associated with the consumption of contaminated non-commercially caught fish and requirements of the Federal Clean Water Act. The proposed project will help determine whether selected waters of the state meet state water quality standards for toxic contaminants in fish as well as providing information about risks to humans and wildlife from the consumption of fish. Potential benefits to ESA-listed species as a result of the project may include the development of pollution control actions such as habitat improvements and/or the reduction or removal of the sources of toxic contaminants. The WDOE proposes to capture (using nets, seines, or electrofishing), sample for biological information, and release adult and juvenile fish. The WDOE also requests juvenile indirect mortality as a result of the research.

**The Action Area**

The proposed actions considered in this Opinion may affect four threatened species: LCR chinook salmon, LCR steelhead, CR chum salmon, and UWR chinook salmon—including the species' habitat. The species habitat consists of the water, substrate, and adjacent riparian zone of estuarine and riverine reaches in hydrologic units and counties. The actions considered in this Opinion would be conducted in specific river and stream sites in Oregon and Washington. More detailed habitat information (i.e., specific watersheds, migration barriers, habitat features, and special management considerations) for these ESUs can be found in the February 16, 2000, *Federal Register* notice designating critical habitat (NOAA 2000). It should be noted, however, that the critical habitat designation was vacated and remanded to NOAA Fisheries for new rulemaking pursuant to a court order in May 2002. In the absence of a new rule designating critical habitat, this consultation will instead evaluate the effects of the proposed actions on the species' habitat to determine whether those actions are likely to jeopardize the species' continued existence.

*LCR chinook salmon*
The action area is defined as the geographic extent of all direct and indirect effects of a proposed agency action [50 C.F.R. 402.02 and 402.14(h)(2)]. For the purposes of this Opinion, the action area includes all rivers, streams, and their tributaries accessible to naturally spawned populations of chinook salmon from the Columbia River and its tributaries from its mouth at the Pacific Ocean upstream to a transitional point between Washington and Oregon east of the Hood River and the White Salmon River, and includes the Willamette River to Willamette Falls, Oregon, exclusive of spring-run chinook salmon in the Clackamas River. Also included are river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to The Dalles Dam. Major river basins containing spawning and rearing habitat for this ESU comprise approximately 6,338 square miles in Oregon and Washington. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Oregon−Clackamas, Clatsop, Columbia, Hood River, Marion, Multnomah, Wasco, and Washington; Washington−Clark, Cowlitz, Klickitat, Lewis, Pierce, Pacific, Skamania, Wahkiakum, and Yakima.

*LCR steelhead*
The action area is defined as the geographic extent of all direct and indirect effects of a proposed agency action [50 C.F.R. 402.02 and 402.14(h)(2)]. For the purposes of this Opinion, the action area includes all rivers, streams, and their tributaries accessible to naturally spawned populations of steelhead in streams and tributaries to the Columbia River between the Cowlitz and Wind Rivers, Washington (inclusive) and the Willamette and Hood Rivers, Oregon (inclusive). Excluded are steelhead in the upper Willamette River Basin above Willamette Falls and steelhead from the Little and Big White Salmon Rivers in Washington. Also included are river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the

Peacock jetty (north jetty, Washington side) upstream to the Hood River in Oregon. Major river basins containing spawning and rearing habitat for this ESU comprise approximately 5,017 square miles in Oregon and Washington. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Oregon−Clackamas, Clatsop, Columbia, Hood River, Marion, Multnomah, and Washington; Washington−Clark, Cowlitz, Lewis, Pacific, Skamania, and Wahkiakum.

*CR chum salmon*
The action area is defined as the geographic extent of all direct and indirect effects of a proposed agency action [50 C.F.R. 402.02 and 402.14(h)(2)]. For the purposes of this Opinion, the action area includes all rivers, streams, and their tributaries accessible to naturally spawned populations of chum salmon in the Columbia River and its tributaries in Washington and Oregon downstream from Bonneville Dam, excluding Oregon tributaries upstream of Milton Creek at river km 144 near the town of St. Helens. Major river basins containing spawning and rearing habitat for this ESU comprise approximately 4,426 square miles in Oregon and Washington. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Oregon−Clatsop, Columbia, Multnomah, and Washington; Washington−Clark, Cowlitz, Lewis, Pacific, Skamania, and Wahkiakum.

*UWR chinook salmon*
The action area is defined as the geographic extent of all direct and indirect effects of a proposed agency action [50 C.F.R. 402.02 and 402.14(h)(2)]. For the purposes of this Opinion, the action area includes all rivers, streams, and their tributaries accessible to listed spring-run chinook salmon in the Clackamas River and in the Willamette River, and its tributaries, above Willamette Falls, Oregon. Also included are river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to and including the Willamette River in Oregon. Major river basins containing spawning and rearing habitat for this ESU comprise approximately 8,575 square miles. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Oregon–Benton, Clackamas, Clatsop, Columbia, Douglas, Lane, Lincoln, Linn, Marion, Multnomah, Polk, Tillamook, Washington, and Yamhill; Washington–Clark, Cowlitz, Pacific, and Wahkiakum.

## STATUS OF THE SPECIES UNDER THE ENVIRONMENTAL BASELINE

In order to describe a species' status, it is first necessary to define precisely what "species" means in this context. Traditionally, one thinks of the ESA listing process as pertaining to entire species of animals or plants. While this is generally true, the ESA also recognizes that there are times when the listing unit must necessarily be a subset of the species as a whole. In these instances, the ESA allows a "distinct population segment" (DPS) of a species to be listed as threatened or endangered.

NOAA Fisheries developed the approach for defining salmonids DPSs in 1991 (Waples 1991). It states that a population or group of populations is considered a distinct population segment if they are "...substantially reproductively isolated from conspecific populations," and if they are considered "...an important component of the evolutionary legacy of the species." A distinct population or group of populations is referred to as an evolutionarily significant unit (ESU) of the species. All of the ESUs addressed in this Opinion are considered DPSs and hence–"species"–under the ESA.

The threatened salmonids identified in the section above were listed under the ESA because NOAA Fisheries determined that a number of factors, both environmental and demographic, had caused them to decline to the point where they were likely to be in danger of going extinct within the foreseeable future. The factors for decline affect biological salmonid requirements at every life stage and arise from a number of different sources. This section of the Opinion explores those effects and defines the context within which they occur.

**Life Histories**

Chinook Salmon

Chinook salmon are the largest of the Pacific salmon. The species' North American distribution historically ranged from the Ventura River in California to Point Hope, Alaska. In northeastern Asia the species range from Hokkaido, Japan to the Anadyr River in Russia (Healey 1991). Additionally, chinook salmon have been reported in the Mackenzie River area of northern Canada (McPhail and Lindsey 1970). Of the Pacific salmon, chinook salmon exhibit the most diverse and complex life-history strategies. Healey (1986) described 16 age categories for chinook salmon, seven total ages at maturity with three possible freshwater ages. Gilbert (1912) initially described two general freshwater life-history types: "stream-type" chinook salmon reside in fresh water for a year or more following emergence; "ocean-type" chinook salmon migrate to the ocean within their first year.

The generalized life history of Pacific salmon includes phases of incubation, hatching, freshwater emergence, migration to the ocean, and subsequent initiation of maturation and return to fresh water for completion of maturation and spawning. Juvenile rearing in fresh water can be minimal or extended. Additionally, some male chinook salmon mature in fresh water, thereby foregoing emigration to the ocean. The timing and duration of each of these stages is related to varying degrees of genetic and environmental determinants and interactions thereof. More detailed descriptions of the key features of chinook salmon life history can be found in Myers et al. (1998) and Healey (1991).

Chinook salmon in the LCR and UWR ESUs exhibit both "ocean type" and "stream type" life histories. Populations tend to mature at ages 3 and 4. Juvenile life stages (i.e., eggs, alevins, fry, and parr) inhabit freshwater/riverine areas throughout the range of the ESU. Parr undergo a smolt transformation as subyearlings or yearlings in the spring at which time they migrate to the ocean. Subadults and adults forage in coastal and offshore waters of the North Pacific Ocean prior to returning to spawn in their natal streams. Adult spring-run chinook salmon typically return to fresh water in April and May and spawn in August and September, while fall-run fish begin to return in August and spawn from late September through January.

*LCR Chinook Salmon ESU*

The LCR chinook salmon ESU is characterized by numerous short- and medium-length rivers that drain the coast ranges and the west slope of the Cascade Mountains. This ESU includes all native populations from the mouth of the Columbia River to the crest of the Cascade Range, excluding populations above Willamette Falls. The former location of Celilo Falls (drowned by The Dalles reservoir in 1960) is the eastern boundary for this ESU. Stream-type, spring-run chinook salmon found in the Klickitat River or the introduced Carson spring chinook salmon strain are not included in this ESU. Spring-run chinook salmon in the Sandy River have been influenced by spring-run chinook salmon introduced from the Willamette River ESU. However, analyses suggest that considerable genetic resources still reside in the existing population (Myers et al. 1998). Tule fall chinook salmon from the LCR chinook salmon ESU were observed spawning in the Ives Island area along the Washington shoreline approximately two miles below Bonneville Dam during October of 1999. Most fall-run fish in the LCR chinook salmon ESU emigrate to the marine environment as sub-yearlings (Reimers and Loeffel 1967, Howell et al. 1985, WDF et al. 1993). Returning adults that emigrated as yearling smolts may have originated from the extensive hatchery programs in the ESU. It is also possible that modifications in the river environment have altered the duration of freshwater residence. Coded-wire-tag (CWT) recoveries of LCR chinook salmon suggest a northerly migration route, but the fish contribute more to fisheries off British Columbia and Washington than to the Alaskan fishery. Tule fall chinook salmon return at adult ages 3 and 4, "bright" fall chinook salmon return at ages 4, 5, and 6.

*UWR Chinook Salmon ESU*
The UWR chinook salmon ESU includes native spring-run populations above Willamette Falls and in the Clackamas River. Historically, it included sizable numbers of spawning salmon in the Santiam River, the middle fork of the Willamette River, and the McKenzie River, as well as smaller numbers in the Molalla River, Calapooia River, and Abiqua Creek. UWR chinook salmon mature in their fourth or fifth years. Historically, 5-year-old fish dominated the spawning migration runs. Recently, however, most fish have matured at age 4. Fish in this ESU are distinct from those of adjacent ESUs in life history and marine distribution. The life history of UWR chinook salmon includes traits from both ocean- and stream-type developmental strategies. CWT recoveries indicate that the fish travel to the marine waters off British Columbia and Alaska. More Willamette River chinook salmon are recovered in Alaskan waters than those from the LCR ESU. The timing of the spawning migration is limited by Willamette Falls. High flows in the spring allow access to the Upper Willamette Basin, whereas low flows in the summer and autumn prevent later-migrating fish from ascending the falls. The low flows may serve as an isolating mechanism, separating this ESU from others nearby.

<u>Steelhead</u>
Steelhead can be divided into two basic run types based on the level of sexual maturity at the time of river entry and the duration of the spawning migration (Burgner et al. 1992). The stream-maturing type, or summer steelhead, enters fresh water in a sexually immature condition and requires several months in fresh water to mature and spawn. The ocean-maturing type, or winter steelhead, enters freshwater with well-developed gonads and spawns shortly after river entry (Barnhart 1986). Variation in migration timing exists between populations. Some river basins have both summer and winter steelhead, others have only one run type. In the Pacific Northwest, summer steelhead enter freshwater between May and October (Busby et al. 1996, Nickelson et al. 1992). During summer and fall, before spawning, they hold in cool, deep pools (Nickelson et al. 1992). They migrate inland toward spawning areas, overwinter in the larger rivers, resume migration to natal streams in early spring, and then spawn (Meehan and Bjornn 1991, Nickelson et al. 1992). Winter steelhead enter freshwater between November and April in the Pacific Northwest (Busby et al. 1996, Nickelson et al. 1992), migrate to spawning areas, and then spawn in late winter or spring.

Unlike Pacific salmon, steelhead are capable of spawning more than once before death. However, it is rare for steelhead to spawn more than twice before dying, and most that do so are females (Nickelson et al. 1992). Steelhead spawn in cool, clear streams with suitable gravel size, depth, and current velocity. Intermittent streams may also be used for spawning (Barnhart 1986, Everest 1973). Steelhead enter streams and arrive at spawning grounds weeks or even months before they spawn and are vulnerable to disturbance and predation during that time.

Depending on water temperature, steelhead eggs may incubate for 1.5 to four months before hatching. Summer rearing takes place primarily in the faster parts of pools, although young-of-the-year are abundant in glides and riffles. Winter rearing occurs more uniformly at lower densities across a wide range of fast and slow habitat types. Productive steelhead habitat is characterized by complexity—primarily in the form of large and small woody debris. Some older juveniles move downstream to rear in larger tributaries and mainstem rivers (Nickelson et al. 1992).

Juveniles rear in fresh water from one to four years, then migrate to the ocean as smolts. Winter steelhead populations generally smolt after two years in freshwater. Steelhead typically reside in marine waters for two or three years before returning to their natal stream to spawn at four or five years of age. Populations in Oregon and California have higher frequencies of age-1-ocean steelhead than populations to the north, but age-2-ocean steelhead generally remain dominant. The age structure appears to be similar to other west coast steelhead—dominated by 4-year-old spawners (Busby et al. 1996). Based on purse-seine catches, juvenile steelhead tend to migrate directly offshore during their first summer, in contrast to salmon which migrate along the coastal belt. Oregon steelhead tend to be north-migrating (Nicholas and Hankin 1988, Pearcy et al. 1990, Pearcy 1992).

*LCR Steelhead ESU*

The LCR steelhead ESU encompasses all steelhead runs in tributaries between the Cowlitz and Wind Rivers on the Washington side of the Columbia River, and the Willamette and Hood Rivers on the Oregon side. The populations of steelhead that make up the LCR ESU are distinguished from adjacent populations by genetic and habitat characteristics. The ESU consists of summer and winter coastal steelhead runs in the tributaries of the Columbia River as it cuts through the Cascades. These populations are genetically distinct from inland populations (east of the Cascades), as well as from steelhead populations in the Upper Willamette River Basin and coastal runs north and south of the Columbia River mouth. The following runs are not included in the ESU: the Willamette River above Willamette Falls (UWR ESU), the Little and Big White Salmon rivers (Middle Columbia River ESU), and runs based on four imported hatchery stocks (early-spawning winter Chambers Creek/Lower Columbia River mix, summer run Skamania Hatchery stock, winter Eagle Creek National Fish Hatchery stock, and winter run Clackamas River ODFW stock) (NOAA 1998). This area has at least 36 distinct runs (Busby et al. 1996), 20 of which were identified in the initial listing petition. In addition, numerous small tributaries have historical reports of fish, but no current abundance data.

<u>Chum Salmon</u>

Historically, chum salmon were distributed throughout the coastal regions of western Canada and the United States, as far south as Monterey Bay, California. Presently, major spawning populations are found only as far south as Tillamook Bay on the northern Oregon coast. Chum salmon spawn primarily in freshwater and, apparently, exhibit obligatory anadromy (there are no recorded landlocked or naturalized freshwater populations, Randall et al. 1987). Chum salmon spend more of their life history in marine waters than do other Pacific salmonids. Chum salmon, like pink salmon, usually spawn in the lower river reaches, with redds usually dug in the mainstem or in side channels of rivers from just above tidal influence to nearly 100 km from the sea. Juveniles outmigrate to seawater almost immediately after emerging from the gravel (Salo 1991). This ocean-type migratory behavior contrasts with the stream-type behavior of some other species in the genus *Oncorhynchus* (e.g., coastal cutthroat trout, steelhead, coho salmon, and most types of chinook and sockeye salmon), which usually migrate to sea at a larger size, after months or years of freshwater rearing. This means that survival and growth in juvenile chum salmon depend less on freshwater conditions (unlike stream-type salmonids which depend heavily on freshwater habitats) than on favorable estuarine conditions. Another behavioral difference between chum salmon and species that rear extensively in freshwater is that chum salmon form schools, presumably to reduce predation (Pitcher 1986), especially if their movements are synchronized to swamp predators (Miller and Brannon 1982).

*CR Chum Salmon ESU*
Chum salmon from the CR ESU spawn in tributaries and in mainstem spawning areas below Bonneville Dam, most often on the Washington side of the Columbia River (Johnson et al. 1997). Chum salmon enter the Columbia River from mid-October through early December and spawn from early November to late December. Recent genetic analysis of fish from Hardy and Hamilton Creeks and from the Grays River indicate that these fish are genetically distinct from other chum salmon populations in Washington (Salo 1991, WDF et al. 1993, Johnson et al. 1997).

**Overview Status of the Species Under Consultation**

To determine a species' status under extant conditions (usually termed "the environmental baseline"), it is necessary to ascertain the degree to which the species' biological requirements are being met at that time and in that action area. For the purposes of this consultation, the biological requirements of these threatened ESUs are expressed in two ways: population parameters such as fish numbers, distribution, and trends throughout the action area; and the condition of various essential habitat features such as water quality, substrate condition, and food availability. Clearly, these two types of information are interrelated. That is, the condition of a given habitat has a large impact on the number of fish it can support. Nonetheless, it is useful to separate the species' biological requirements into these parameters because doing so provides a more complete picture of all the factors affecting the survival of listed fish. Therefore, the discussion to follow will be divided into two parts: Species Distribution and Trends, and Factors Affecting the Environmental Baseline.

**Species Distribution and Trends**

<u>LCR Chinook Salmon</u>
Recent adult return data for this ESU is summarized in NOAA Fisheries' biological opinion on the operation of the Federal Columbia River Power System (NOAA Fisheries 2000a). Historical records of chinook salmon abundance are sparse, but cannery records suggest a peak run of 4.6 million fish in 1883. Although fall-run chinook salmon are still present throughout much of their historical range, most of the fish spawning today are first-generation hatchery strays. Furthermore, spring-run populations have been severely depleted throughout the ESU and extirpated from several rivers.

In 1998, NOAA Fisheries reassessed the status of this ESU (Meyers et al. 1998) which concluded that chinook salmon in this ESU are not presently in danger of extinction but are likely to become so in the foreseeable future. Updated abundance information illustrated that smaller tributary streams in the range of this ESU support naturally spawning spring run chinook salmon numbering only in the hundreds of fish, while larger tributaries (e.g., Cowlitz River Basin) contain natural spring run chinook salmon runs ranging in size from 100 to 1,000 fish. Apart from the relatively large and apparently healthy fall-run population in the Lewis and Cowlitz Rivers, production in this ESU appears to be predominantly hatchery-driven with few identifiable native, naturally reproducing populations. Long- and short-term trends in abundance of individual populations are negative, some severely so. About half of the populations comprising this ESU are very small, increasing the risks of extirpation due to genetic and demographic processes. Numbers of naturally spawning spring-run chinook salmon are very low, and native populations in the Sandy and Clackamas Rivers have been supplanted by spring-run fish from the Upper Willamette River. There have been at least six documented extinctions of populations in this ESU and it is possible that extirpation of other native populations has occurred but has been masked by the presence of naturally spawning hatchery fish.

Freshwater habitat in the range of LCR chinook salmon is in poor condition in many basins, with problems related to forestry practices, urbanization, and agriculture. Dam construction on the Cowlitz, Lewis, White Salmon, and Sandy Rivers has eliminated access to a substantial portion of the spring-run spawning habitat, with a lesser impact on fall-run habitat (Myers et al. 1998).

UWR Chinook Salmon

There are no direct estimates of the size of the chinook salmon runs in the Willamette River Basin before the 1940s. McKernan and Mattson (1950) present anecdotal information that the Native American fishery at Willamette Falls may have yielded 2,000,000 pounds of salmon (a run size of 454,000 fish, each weighing 20 pounds). Based on egg collections at salmon hatcheries, Mattson (1948) estimates that the spring chinook salmon run in the 1920s may have been five times the run size of 55,000 fish in 1947, or 275,000 fish. Much of the early information on salmon runs in the Upper Willamette River Basin comes from operation reports of state and Federal hatcheries. Although the total number of fish returning to the Willamette has been relatively high (24,000), recent natural escapement is less than 5,000 fish and has been declining sharply. Furthermore, it is estimated that about two-thirds of the natural spawners are first-generation hatchery fish, suggesting that the natural population growth rate is well below replacing itself. The McKenzie River supports the only remaining naturally reproducing population in the ESU (ODFW 1998). NOAA Fisheries estimates 2,523 adults will return to spawn this year.

A NOAA Fisheries chinook salmon status review concluded that chinook salmon in this ESU are not presently in danger of extinction but are likely to become so in the foreseeable future and noted a similarity between population dynamic parameters of UWR chinook salmon and those for the Upper Columbia River steelhead ESU, which was recently listed as endangered by NOAA Fisheries.

The introduction of fall-run chinook salmon into the basin and the laddering of Willamette Falls have increased the potential for genetic introgression between wild spring- and hatchery fall-run chinook salmon, but there is no direct evidence of hybridization between these two runs. The proximate sources of risk to chinook salmon in this ESU are habitat blockages of large areas of important spawning and rearing habitat by dam construction. Remaining habitat has been degraded by effects of damming, forestry practices, agriculture, and urbanization. Another concern for this ESU is that levels of commercial and recreational harvest are high relative to the apparent productivity of natural populations (Myers et al. 1998).

<u>LCR Steelhead</u>
Recent adult return data for this ESU are summarized in NOAA Fisheries' biological opinion on the operation of the Federal Columbia River Power System (FCRPS) (NOAA Fisheries 2000a). For the larger runs, (Cowlitz, Kalama, and Sandy Rivers), current counts have been in the range of 1,000 to 2,000 fish. Historical counts for these runs, however, were more than 20,000 fish. In general, all the runs in the ESU have declined over the past 20 years, exhibiting sharp declines in the last five years. Escapement estimates for the steelhead fishery in the LCR ESU are based on in-river and estuary sport-fishing reports. There is also a limited ocean fishery on this ESU. Harvest rates range from 20% to 50% of the total run, but harvest rates on naturally produced fish have dropped to 0% to 4% in recent years (punch card data from Washington Department of Fish and Wildlife [WDFW] through 1994).

A NOAA Fisheries steelhead status review (1997) concluded that this ESU is not presently in danger of extinction but is likely to become so in the foreseeable future. The majority of stocks for which we have data within this ESU have been declining recently, but some have shown strong increases. However, the strongest upward trends are those of either non-native stocks (Lower Willamette River and Clackamas River summer steelhead) or stocks that are recovering from major habitat disruption and are still at low abundance (mainstem and North Fork Toutle River). The data series for most stocks are quite short, so the preponderance of downward trends may reflect a general coastwide decline in steelhead abundances in recent years.

The major area of uncertainty in this evaluation is the degree of interaction between hatchery and natural stocks within the ESU. There is widespread production of hatchery steelhead within this ESU and several stocks for which we have hatchery composition estimates average more than 50% hatchery fish in natural escapement. Concerns about hatchery influence are especially strong for summer steelhead and Oregon winter steelhead stocks, where there appears to be substantial overlap in spawning between hatchery and natural fish. WDFW's conclusion that there is little overlap in spawning between natural and hatchery stocks of winter steelhead throughout the ESU is generally supported by available evidence. However, with the exception of detailed studies of the Kalama River winter stock, it is based largely on models with assumed run times rather than empirical data. There is apparently strong overlap in spawning between hatchery and natural summer steelhead in tributaries on the Washington side of the lower Columbia River. We have no information regarding potential spawning separation between hatchery and natural fish in Oregon tributaries of the lower Columbia River (Busby et al. 1996).

<u>CR Chum Salmon</u>
Recent adult return data for this ESU are summarized in NOAA Fisheries' biological opinion on the operation of the FCRPS (NOAA Fisheries 2000a). Previously, chum salmon were reported in almost every river in the lower Columbia River Basin, but most runs disappeared by the 1950s (Rich 1942, Marr 1943, Fulton 1970). Historically, the CR chum salmon ESU supported a large commercial fishery landing more than 500,000 fish per year. Commercial catches declined beginning in the mid-1950s. There are now no recreational or directed commercial fisheries for chum salmon in the Columbia River, although chum salmon are taken incidentally in the gill-net fisheries for coho and chinook salmon, and some tributaries have a minor recreational harvest. The estimated minimum run size for the CR chum salmon ESU has been relatively stable, although at a very low level, since the run collapsed during the mid-1950s. Current abundance is probably less than 1% of historical levels, and the ESU has undoubtedly lost some (perhaps much) of its original genetic diversity. Currently, the WDFW regularly

monitors only a few natural populations in the basin: one in the Grays River, two in small streams near Bonneville Dam, and one in the mainstem area next to one of the latter two streams. Hatchery fish have had little influence on the naturally produced component of the CR chum salmon ESU.

Because of the well-known aversion of chum salmon to surmounting in-river obstacles to migration, the effects of the mainstem Columbia River hydropower system have probably been more severe for chum salmon than for other salmon species. Bonneville Dam presumably continues to impede the recovery of upriver populations. Substantial habitat loss in the Columbia River estuary and associated areas presumably was an important factor in the decline and also represents a significant continuing risk for this ESU.

Conclusion

The degree to which each of these ESU's biological requirements are being met, with respect to population numbers and distribution has not improved significantly since the time of listing. While some improvement can be seen throughout a given ESU as a whole, populations in critical subbasins continue to exhibit declining trends. Therefore, while there is some cause for optimism, there has been no genuine change in the status of each of these ESUs since they were listed and most likely their biological requirements are not being met with respect to abundance, distribution, and overall population trend.

**Factors Affecting the Environmental Baseline**

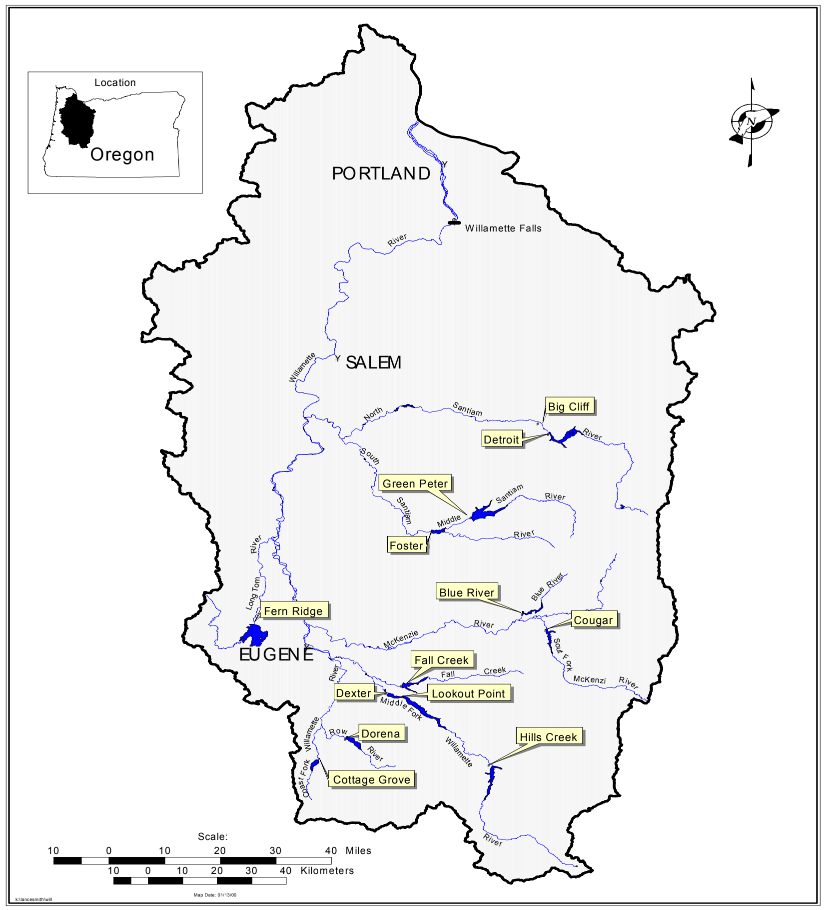
Environmental baselines for biological opinions are defined by regulation at 50 CFR 402.02, which states that an environmental baseline is the physical result of all past and present state, Federal, and private activities in the action area along with the anticipated impacts of all proposed Federal projects in the action area (that have already undergone formal or early section 7 consultation). The environmental baseline for *this* Opinion is therefore the result of the impacts a great many activities (summarized below) have had on the survival and recovery of the listed salmonids under this Opinion. Put another way (and as touched upon previously), the baseline is the culmination of the effects that multiple activities have had on the species' *biological requirements* and, by examining those individual effects, it is possible to derive the species' status in the action area.

Many of the biological requirements for LCR chinook salmon, LCR steelhead, CR chum salmon, and UWR chinook salmon in the action area can best be expressed in terms of essential habitat features. That is, the salmonids require adequate: (1) substrate (especially spawning gravel); (2) water quality; (3) water quantity; (4) water temperature; (5) water velocity; (6) cover/shelter; (7) food; (8) riparian vegetation; (9) space, and (10) migration conditions (NOAA 2000). The best scientific information presently available demonstrates that a multitude of factors, past and present, have contributed to the decline of west coast salmonids by adversely affecting these essential habitat features. NOAA Fisheries reviewed much of that information in its recent FCRPS consultation (NOAA Fisheries 2000a). That review is summarized in the sections below.

It is important to note that while the discussion below may not specifically address each ESU covered in this Opinion, it is simply a case of there being more data on how the various factors for decline have affected some species than others. Nonetheless, even though there may not be as much data on some of the ESUs, it can be conclusively stated that the factors affecting every other salmonid species in the Columbia and Willamette River Basins affect the ESUs considered here as well. Therefore, in every instance cited below—whether hydropower development or habitat destruction or any other factor—it can be said that LCR chinook salmon, LCR steelhead, CR chum salmon, and UWR chinook salmon have all suffered negative effects similar to those described for the species studied. It should be further noted that the discussion below is simply a solid overview—rather than an exhaustive treatment—of the factors affecting these species/ESUs. For greater detail, see Busby et al. (1996) and NOAA Fisheries (1991).

<u>The Hydropower System</u>

Hydropower development in the Willamette and Columbia Basins has dramatically affected anadromous salmonids. Storage dams have eliminated spawning and rearing habitat and altered the natural hydrology of the Willamette and Columbia Rivers—decreased spring and summer flows, and increasing fall and winter flows. Fluctuations in river flow and elevation caused by hydropower operations can impact fish movements patterns, alter riparian ecology, and strand fish in shallow areas. There are some 371 dams in the Willamette Basin alone (Allen et al. 1999), 13 of which are major U.S. Army Corps of Engineers projects (see adjacent map). The Willamette Project dams can kill juveniles and adults and alter migration patterns and behaviors. The dams in the upper Willamette River have converted once-swift river reaches into slow-moving reservoirs, thus slowing the smolts' journey to the ocean and creating habitat for predators.




UWR chinook salmon navigate many major hydroelectric projects during their up- and downstream migrations. In contrast, LCR chinook salmon, LCR steelhead, and CR chum salmon only have to navigate Bonneville Dam but are still impacted by upstream dam operations. For example, because of the well-known aversion of chum salmon to surmounting in-river obstacles to migration, the effects of the mainstem Columbia River hydropower system have probably been more severe for chum salmon than for other salmon species. Bonneville Dam presumably continues to impede recovery of upriver populations (Johnson et al. 1997) and populations down river suffer from fluctuations in flow that often make spawning habitat inaccessible or strand adult and juvenile fish.

Human-Induced Habitat Degradation

The quality and quantity of freshwater habitat in much of the Columbia River Basin, including the Willamette subbasin, have declined dramatically in the last 150 years. Forestry, farming, grazing, road construction, mining, and urban development have radically changed the historical habitat conditions of the basin. With the exception of fall chinook and chum salmon, which generally spawn and rear in the mainstem rivers, salmon and steelhead spawning and rearing habitat is found in the tributaries to the Columbia and Willamette Rivers. More than 2,500 streams, river segments, and lakes do not meet Federally-approved, state and Tribal water quality standards and are now listed as water-quality-limited under Section 303(d) of the Clean Water Act. Tributary water quality problems contribute to poor water quality when sediment and contaminants from the tributaries settle in mainstem reaches and the estuary. Most of the water bodies in Oregon and Washington on the 303(d) list do not meet water quality standards for temperature. High water temperatures adversely affect salmonid metabolism, growth rate, and disease resistance, as well as the timing of adult migrations, fry emergence, and smoltification. Many factors can cause high stream temperatures, but they are primarily related to land-use practices rather than point-source discharges. Some common actions that cause high stream temperatures are the removal of trees or shrubs that directly shade streams, water withdrawals for irrigation or other purposes, and warm irrigation return flows. Loss of wetlands and increases in groundwater withdrawals contribute to lower base-stream flows, which in turn contribute to temperature increases. Activities that create shallower streams (e.g., channel widening) also cause temperature increases. For more information on the effects associated with habitat degradation—e.g., problems associated with pollution, sedimentation, increased water temperatures, passage barriers, and loss of habitat complexity and refugia—as well as some of the measures being taken to mitigate these effects, see NOAA Fisheries (2002b).

Hatcheries

For more than 100 years, hatcheries in the Pacific Northwest have been used to produce fish for harvest and replace natural production lost to dam construction and other development—not to protect and rebuild naturally produced salmonid populations. As a result, most salmonid populations in the region are primarily derived from hatchery fish. In 1987, for example, 95% of the coho salmon, 70% of the spring chinook salmon, 80% of the summer chinook salmon, 50% of the fall chinook salmon, and 70% of the steelhead returning to the Columbia River Basin, including the Willamette subbasin, originated in hatcheries (CBFWA 1990). Some hatchery percentage estimates, proportions of hatchery fish relative to total run size, by subbasin are: UWR chinook salmon are 90% in the basin (Chilcote 1997 and 1998), LCR steelhead are 92% in the Cowlitz River, 77% in the Kalama River, 50% in the North Fork Washougal River, 0% in the mainstem Washougal River, and 0% to 1% in the North Fork Toutle and Wind rivers (NOAA Fisheries 2000a). Because hatcheries have traditionally focused on providing fish for harvest and replacing declines in native runs (and generally not carefully examined their own effects on local populations), it is only recently that the substantial effects of hatcheries on native naturally produced populations been documented. For example, the production of hatchery fish, among other factors, has contributed to the 90% reduction in naturally produced coho salmon runs in the Lower Columbia River over the past 30 years (Flagg et al. 1995).

Hatchery fish can harm native, naturally produced salmon and steelhead in four primary ways: (1) ecological effects, (2) genetic effects, (3) overharvest effects, and (4) masking effects (NOAA Fisheries 2000a). Ecologically, hatchery fish can predate on, displace, and compete with naturally produced fish. These effects are most likely to occur when fish are released in poor condition and do not migrate to marine waters, but rather remain in the streams for extended rearing periods. Hatchery fish also may transmit hatchery-borne diseases, and hatcheries themselves may release disease-carrying effluent into streams. Hatchery fish can affect the genetic composition of native fish by interbreeding with them. Interbreeding can also result from the introduction of native stocks from other areas. Theoretically, interbred fish are less adapted to the local habitats where the original native stock evolved and are therefore less productive.

Harvest

Salmon and steelhead have been harvested in the Columbia Basin, including the Willamette subbasin, as long as people have been there. Commercial fishing developed rapidly with the arrival of European settlers and the advent of canning technologies in the late 1800s. The development of non-Indian fisheries began in about 1830; by 1861, commercial fishing was an important economic activity. The early commercial fisheries used gill nets, seines hauled from shore, traps, and fish wheels. Later, purse seines and trolling (using hook and line) fisheries developed. Recreational (sport fishing) harvest began in the late 1800s, occurring primarily in tributary locations (ODFW and WDFW 1998).

Initially, the non-Native American fisheries targeted spring and summer chinook salmon, and these runs dominated the commercial harvest during the 1800s. Eventually the combined ocean and freshwater harvest rates for Columbia River spring and summer chinook salmon, including the LCR and UWR ESUs, exceeded 80% and sometimes 90% of the run—accelerating the species' decline (Ricker 1959). From 1938 to 1955, the average harvest rate dropped to about 60% of the total spring chinook salmon run and appeared to have a minimal effect on subsequent returns (NOAA Fisheries 1991). Conservation concerns for naturally produced runs of salmon and steelhead have resulted in current harvest regulations in Washington and Oregon that limit the numbers of fish anglers can capture per day and per year. In addition these fisheries specifically target hatchery fish.

Until the spring of 2000—when a relatively large run of hatchery spring chinook salmon returned—no commercial harvest for spring chinook salmon had taken place since 1977. Present Columbia and Willamette River harvest rates are very low compared with those from the late 1930s through the 1960s (NOAA Fisheries 1991). Though steelhead and chum salmon were never as important a component of the Columbia Basin's fisheries as chinook salmon, net-based fisheries generally do not discriminate among species, so it can fairly be said that harvest has also contributed to the decline of all salmonid ESUs addressed in this consultation.

Natural Conditions

Natural changes in the freshwater and marine environments play a major role in salmonid abundance. Recent evidence suggests that marine survival among salmonids fluctuates in response to 20- to 30-year cycles of climatic conditions and ocean productivity (Hare et al. 1999). This phenomenon has been referred to as the Pacific Decadal Oscillation. In addition, large-scale climatic regime shifts, such as El Niño, appear to change ocean productivity. During the first part of the 1990s, much of the Pacific Coast was subject to a series of very dry years. More recently, severe flooding has adversely affected some stocks (e.g., the low returns of Lewis River bright fall chinook salmon in 1999).

A key factor affecting many West Coast stocks has been a general 30-year decline in ocean productivity. The mechanism whereby stocks are affected is not well understood, partially because the pattern of response to these changing ocean conditions has differed among stocks, presumably due to differences in their ocean timing and distribution. It is presumed that survival is driven largely by events occurring between ocean entry and recruitment to a subadult life stage.

Scientific Research

ESA-listed and other fish in the Lower Columbia River Basin and Willamette River subbasin are the subject of scientific research and monitoring activities. Most biological opinions NOAA Fisheries issues recommend specific monitoring, evaluation, and research projects to gather information to aid the survival of listed fish. In addition, NOAA Fisheries has issued numerous research permits authorizing takes of ESA-listed fish over the last few years. On February 20, 2002, NOAA Fisheries completed a formal consultation [F/NWR/1998/01377] on studies affecting LCR chinook salmon, LCR steelhead, CR chum salmon, UWR steelhead and UWR chinook salmon (NOAA Fisheries 2002b). Also in 2002, NOAA Fisheries provided a limit on take prohibitions for scientific research activities permitted or conducted by state fishery agencies under the 4(d) rule (NOAA Fisheries 2002c).

Each authorization by itself would not lead to a decline of the species. However the sum of the authorized takes indicate a high level of research effort in the action area, and as anadromous fish stocks have continued to decline, the proportion of fish handled for research/monitoring purposes has increased. The effect of these activities is difficult to assess because despite the fact that fish are harassed and even killed in the course of scientific research, these activities have a great potential to benefit ESA-listed salmon and steelhead. For example, aside from simply increasing what is known about the listed species and their biological requirements, research is essentially the only way to answer key questions associated with difficult resource issues that arise in every management arena and involve every salmonid life history stage (particularly the resource issues discussed in the previous sections). Perhaps most importantly, the information gained during research and monitoring activities can help resource managers recover listed species. That is, no rational resource allocation or management decisions can be made without the knowledge to support them. Further, there is no way to tell if the corrective measures described in the previous sections are working unless they are monitored and no way to design new and better ones if research is not done.

In any case, scientific research and monitoring efforts (unlike the other factors described in the previous sections) are not considered to be a factor contributing to the decline of listed salmonids, and NOAA Fisheries believes that the information derived from the research activities is essential to their survival and recovery. Nonetheless, fish *are* harmed during research activities. And activities that are carried out in a careless or undirected fashion are not likely to benefit the species at all. Therefore, to reduce adverse effects from research activities on the species, NOAA Fisheries imposes conditions in its permits so that permit holders conduct their activities in such a way as to minimize adverse effects on the ESA-listed species, including keeping mortalities as low as possible. Also, researchers are encouraged to use non-listed fish species and hatchery fish instead of listed naturally produced fish when possible. In addition, researchers are required to share fish samples, as well as the results of the scientific research, with other researchers and co-managers in the region as a way to avoid duplicative research efforts and to acquire as much information as possible from the ESA-listed fish sampled. NOAA Fisheries also works with other agencies to coordinate research and thereby prevent duplication of effort.

In general, for projects that require a section 10(a)(1)(A) permit, applicants provide NOAA Fisheries with high take estimates to compensate for potential in-season changes in research protocols, accidental catastrophic events, and the annual variability in listed fish numbers. Also, most research projects depend on annual funding and the availability of other resources. So, a specific research project for which take of ESA-listed species is authorized by a permit may be suspended in a year when funding or resources are not available. As a result, the *actual* take in a given year for all research projects, as provided to NOAA Fisheries in post-season annual reports, is usually less than the authorized level of take in the permits and the related NOAA Fisheries biological opinion on the issuance of those permits. Therefore, because actual take levels tend to be lower than authorized takes, the severity of effects to the ESA-listed species due to the conduct of scientific research activities are usually less than the effects analyzed in a typical biological opinion.

<u>Summary</u>

In conclusion, the picture of whether biological requirements are being met is more clear-cut for habitat-related parameters than it is for population factors: given all the factors for decline—even taking into account the conservation measures being implemented—it is still clear that the biological requirements for LCR chinook salmon, LCR steelhead, CR chum salmon, and UWR chinook salmon are currently not being met under the environmental baseline. Their status is such that there must be a significant improvement in the environmental conditions of the species' respective habitats (over those currently available under the environmental baselines). Any further degradation of the environmental conditions would have a large impact because the species is already at risk. In addition, there must be improvements to minimize impacts due to dams, harvest, hatchery operations, habitat degradation, and unfavorable natural conditions.

## EFFECTS OF THE ACTION

The purpose of this section is to identify the effects NOAA Fisheries' issuance of scientific research permits will have on threatened LCR chinook salmon, LCR steelhead, CR chum salmon, and UWR chinook salmon. To the extent possible, this will include analyses of effects at the population level. Where information on these listed salmonids is lacking at the population level, this analysis assumes that the status of each affected population is the same as the ESU as a whole. The method NOAA Fisheries uses for evaluating effects is discussed first, followed by discussions of the general effects that scientific research activities are known to have and permit-specific effects.

### Evaluating the Effects of the Action

Over the course of a decade and hundreds of ESA section 7 consultations, NOAA Fisheries developed the following four-step approach for applying the ESA Section 7(a)(2) standards when determining what effect a proposed action is likely to have on a given listed species. What follows here is a summary of that approach[1].

1. Define the biological requirements and current status of each listed species.
2. Evaluate the relevance of the environmental baseline to the species' current status.

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[1] For more detail please see pages 4-10 of *The Habitat Approach: Implementation of Section 7 of the Endangered Species Act for Actions Affecting the Habitat of Pacific Salmonids* (NOAA Fisheries 1999).

3. Determine the effects of the proposed or continuing action on listed species and their habitat.
4. Determine whether the species can be expected to survive with an adequate potential for recovery under (a) the effects of the proposed (or continuing) action, (b) the effects of the environmental baseline, and (c) any cumulative effects—including all measures being taken to improve salmonid survival and recovery.

The fourth step above requires a two-part analysis. The first part focuses on the action area and defines the proposed action's effects in terms of the species' biological requirements in that area (i.e., impacts on essential habitat features). The second part focuses on the species itself. It describes the action's impact on individual fish—or populations, or both—and places that impact in the context of the ESU as a whole. Ultimately, the analysis seeks to answer the questions of whether the proposed action is likely to jeopardize a listed species' continued existence or destroy or adversely modify its habitat.

**Effects on Habitat**

Previous sections have detailed the circumstances surrounding the designation of ESUs under consultation, described the essential features of that habitat, and depicted its present condition. The discussion here focuses on how those features are likely to be affected by the proposed actions.

Full descriptions of the proposed activities are found in the next section. In general, the activities will be (a) electrofishing—using both backpack- and boat-based equipment, (b) streamside and snorkel surveys in spawning and rearing habitat, (c) smolt trapping at dams, and (d) capturing fish with angling equipment, traps, and nets of various types. All of these techniques are minimally intrusive in terms of their effect on habitat. None of them will measurably affect any of the 10 essential fish habitat features listed earlier (i.e., stream substrates, water quality, water quantity, food, streamside vegetation, etc.). Moreover, the proposed activities are all of short duration. Therefore, NOAA Fisheries concludes that the proposed activities are unlikely to have an adverse impact on habitat.

**Effects on LCR Chinook Salmon, LCR Steelhead, CR Chum Salmon, and UWR Chinook Salmon**

The primary effects the proposed activities will have on LCR chinook salmon, LCR steelhead, CR chum salmon, and UWR chinook salmon will occur in the form of direct "take" (the ESA take definition is given in the Description of the Proposed Actions section) a portion of which takes the form of harassment. Harassment generally leads to stress and other sub-lethal effects and is caused by observing, capturing, and handling fish. The ESA does not define harassment nor has NOAA Fisheries defined this term through regulation pursuant to the ESA. However, the USFWS defines "harassment as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to breeding, feeding or sheltering" [50 CFR 17.3]. For the purposes of this analysis, NOAA Fisheries adopts this definition of harassment.

The various proposed activities, described under permit specific effects, would cause many types of take and while there is some blurring of the lines between what constitutes an activity (e.g., electrofishing) and what constitutes a take category (e.g., harm), it is important to keep the two concepts separate. The reason for is this is that the effects being measured here are those which the activity itself has on the listed species. They may be expressed in *terms* of the take categories (e.g., how many listed salmonids are harmed, or harassed, or even killed), but the actual mechanisms of the effects themselves (i.e., the activities) are the causes of whatever take arises and, as such, they bear examination. Therefore, the first part of this section is devoted to a discussion of the general effects known to be caused by the proposed activities, regardless of where they occur or what species are involved.

The following subsections describe the types of activities being proposed. Because they would all be carried out by trained professionals using established protocols and have widely recognized specific impacts, each activity is described in terms broad enough to apply to every proposed permit. This is especially true in light of the fact that the researchers would not receive a permit unless their activities (e.g., electrofishing) incorporate NOAA Fisheries' uniform, pre-established set of mitigation measures. These measures are described in the Description of the Proposed Actions section of this Opinion. They are incorporated (where relevant) into every permit as part of the terms and conditions to which a researcher must adhere.

<u>Observation</u>

For some studies, ESA-listed fish will be observed in-water (i.e., snorkel surveys). Direct observation is the least disruptive and simplest method for determining presence/absence of the species and estimating their relative abundance. Its effects are also generally the shortest-lived among any of the research activities discussed in this section. Typically, a cautious observer can effectively obtain data without disrupting the normal behavior of a fish. Fry and juveniles frightened by the turbulence and sound created by observers are likely to seek temporary refuge behind rocks, vegetation, and deep water areas. In extreme cases, some individuals may temporarily leave the particular pool or habitat type when observers are in their area. Researchers minimize the amount of disturbance by moving through streams slowly—thus allowing ample time for fish to reach escape cover; though it should be noted that the research may at times involve observing adult fish which are more sensitive to disturbance. During some of the research activities discussed below, redds may be visually inspected, but no redds will be walked on. Harassment is the primary form of take associated with these observation activities, and few if any injuries or deaths are expected to occur—particularly in cases where the observation is to be conducted solely by researchers on the stream banks rather than in the water. There is little a researcher can do to mitigate the effects associated with observation activities because those effects are so minimal. In general, all they can do is move with care and attempt to avoid disturbing sediments, gravels, and, to the extent possible, the fish themselves.

<u>Capture/handling</u>

Capturing and handling fish causes them stress—though they typically recover fairly rapidly from the process and therefore the overall effects of the procedure are generally short-lived. The primary contributing factors to stress and death from handling are excessive doses of anesthetic, differences in water temperatures (between the river and wherever the fish are held), dissolved oxygen conditions, the amount of time that fish are held out of the water, and physical trauma. Stress on salmonids increases rapidly from handling if the water temperature exceeds 18°C or dissolved oxygen is below saturation. Fish that are transferred to holding tanks can experience trauma if care is not taken in the transfer process, and fish can experience stress and injury from overcrowding in traps if the traps are not emptied on a regular basis. Debris buildup at traps can also kill or injure fish if the traps are not monitored and cleared on a regular basis.

Based on prior experience with the research techniques and protocols that would be used to conduct the proposed scientific research, no more than five percent of the juvenile salmonids encountered are likely to be killed as an indirect result of being captured and handled and, in most cases, that figure will not exceed three percent. None of the adults being handled are expected to die. In any case, all researchers will employ the mitigation measures described earlier and thereby keep adverse effects to a minimum. Finally, any fish indirectly killed by the research activities in the proposed permits may be retained as reference specimens or used for analytical research purposes.

Electrofishing

Electrofishing is a process by which an electrical current is passed through water containing fish in order to stun them—thus making them easy to capture. It can cause a suite of effects ranging from simple harassment to actually killing the fish (adults and juveniles) in an area where it is occurring. The amount of unintentional mortality attributable to electrofishing may vary widely depending on the equipment used, the settings on the equipment, and the expertise of the technician. Electrofishing can have severe effects on adult salmonids. Spinal injuries in adult salmonids from forced muscle contraction have been documented. Sharber and Carothers (1988) reported that electrofishing killed 50% of the adult rainbow trout in their study. The long-term effects electrofishing has on both juveniles and adult salmonids are not well understood, but long experience with electrofishing indicates that most impacts occur at the time of sampling and are of relatively short duration.

The effects electrofishing will have on the listed salmonids under this consultation would be limited to the direct and indirect effects of exposure to an electric field, capture by netting, holding captured fish in aerated tanks, and the effects of handling associated with transferring the fish back to the river (see the next subsection for more detail on capturing and handling effects). Most of the studies on the effects of electrofishing on fish have been conducted on adult fish greater than 300 mm in length (Dalbey et al. 1996). The relatively few studies that have been conducted on juvenile salmonids indicate that spinal injury rates are substantially lower than they are for large fish. Smaller fish intercept a smaller head-to-tail potential than larger fish (Sharber and Carothers 1988) and may therefore be subject to lower injury rates (Hollender and Carline 1994, Dalbey et al. 1996, Thompson et al. 1997). For example, McMichael et al. (1998) found a 5.1% injury rate for juvenile Middle Columbia River steelhead captured by electrofishing in the Yakima River subbasin. The incidence and severity of electrofishing damage is partly related to the type of equipment used and the waveform produced (Sharber and Carothers 1988, McMichael 1993, Dalbey et al. 1996, Dwyer and White 1997). Continuous direct current (DC) or low-frequency ($\leq$30 Hz) pulsed DC have been recommended for electrofishing (Fredenberg 1992, Snyder 1992 and 1995, Dalbey et al. 1996) because lower spinal injury rates, particularly in salmonids, occur with these waveforms (Fredenberg 1992, Taube 1992, McMichael 1993, Sharber et al. 1994, Dalbey et al. 1996). Only a few recent studies have examined the long-term effects of electrofishing on salmonid survival and growth (Ainslie et al. 1998, Dalbey et al. 1996, Taube 1992). These studies indicate that although some of the fish suffer spinal injury, few die as a result. However, severely injured fish grow at slower rates and sometimes they show no growth at all (Dalbey et al. 1996).

NOAA Fisheries' electrofishing guidelines (NOAA Fisheries 2000c) will be followed in all surveys requiring this procedure. The guidelines require that field crews be trained in observing animals for signs of stress and shown how to adjust electrofishing equipment to minimize that stress. Electrofishing is used only when other survey methods are not feasible. All areas for stream and special needs surveys are visually searched for fish before electrofishing may begin. Electrofishing is not done in the vicinity of redds or spawning adults. All electrofishing equipment operators are trained by qualified personnel to be familiar with equipment handling, settings, maintenance, and safety. Operators work in pairs to increase both the number of fish that may be seen and the ability to identify individual fish without having to net them. Working in pairs also allows the researcher to net fish before they are subjected to higher electrical fields. Only DC units will be used, and the equipment will be regularly maintained to ensure proper operating condition. Voltage, pulse width, and rate will be kept at minimal levels and water conductivity will be tested at the start of every electrofishing session so those minimal levels can be determined. Due to the low settings used, shocked fish normally revive instantaneously. Fish requiring revivification will receive immediate, adequate care.

The preceding discussion focused on the effects of using a backpack unit for electrofishing and the ways those effects will be mitigated. It should be noted, however, that in larger streams and rivers electrofishing units are sometimes mounted on boats. These units often use more current than backpack electrofishing equipment because they need to cover larger (and deeper) areas and, as a result, can have a greater impact on fish. In addition, the environmental conditions in larger, more turbid streams can limit researchers' ability to minimize impacts on fish. For example, in areas of lower visibility it is difficult for researchers to detect the presence of adults and thereby take steps to avoid them. Because of its greater potential to harm fish, and because NOAA Fisheries has not published appropriate guidelines, boat electrofishing has not been given a general authorization under NOAA Fisheries' recent ESA section 4(d) rules. However, it is expected that guidelines for safe boat electrofishing will be in place in the near future. And in any case, all researchers intending to use boat electrofishing will use all means at their disposal to ensure that a minimum number of fish are harmed (these means will include a number of long-established protocols that will eventually be incorporated int NOAA Fisheries' guidelines).

<u>Tagging/marking</u>

Techniques such as PIT-tagging (passive integrated transponder tagging), coded wire tagging, fin-clipping, and the use of radio transmitters are common to many scientific research efforts using ESA-listed species. All sampling, handling, and tagging procedures have an inherent potential to stress, injure, or even kill the marked fish. This section discusses each of the marking processes and its associated risks.

A PIT tag is an electronic device that relays signals to a radio receiver; it allows salmonids to be identified whenever they pass a location containing such a receiver (e.g., any of several dams) without researchers having to handle the fish again. The tag is inserted into the body cavity of the fish just in front of the pelvic girdle. The tagging procedure requires that the fish be captured and extensively handled, therefore any researchers engaged in such activities will follow the conditions listed in the Description of the Proposed Actions section of this Opinion (as well as any permit-specific terms and conditions) to ensure that the operations take place in the safest possible manner. In general, the tagging operations will take place where there is cold water of high quality, a carefully controlled environment for administering anesthesia, sanitary conditions, quality control checking, and a carefully regulated holding environment where the fish can be allowed to recover from the operation.

PIT tags have very little effect on growth, mortality, or behavior. The few reported studies of PIT tags have shown no effect on growth or survival (Prentice et al. 1987 and 1990; Jenkins and Smith 1990). For example, in a study between the tailraces of Lower Granite and McNary Dams (225 km), Hockersmith et al. (2000) concluded that the performance of yearling chinook salmon was not adversely affected by gastrically- or surgically-implanted sham radio tags or PIT-tags. Additional studies have shown that growth rates among PIT-tagged Snake River juvenile fall chinook salmon in 1992 (Rondorf and Miller 1994) were similar to growth rates for salmon that were not tagged (Conner et al. 2001). Prentice and Park (1984) also found that PIT-tagging did not substantially affect survival in juvenile salmonids.

The other primary method for tagging fish is to implant them with radio tags. There are two main ways to accomplish this and they differ in both their characteristics and consequences. First, a tag can be inserted into a fish's stomach by pushing it past the esophagus with a plunger. Stomach insertion does not cause a wound and does not interfere with swimming. This technique is benign when salmon are in the portion of their spawning migrations during which they do not feed (Nielsen 1992). In addition, for short-term studies, stomach tags allow faster post-tagging recovery and interfere less with normal behavior than do tags attached in other ways.

The second method for implanting radio tags is to place them within the body cavities of (usually juvenile) salmonids. These tags do not interfere with feeding or movement. However, the tagging procedure is difficult, requiring considerable experience and care (Nielsen 1992). Because the tag is placed within the body cavity, it is possible to injure a fish's internal organs. Infections of the sutured incision and the body cavity itself are also possible, especially if the tag and incision are not treated with antibiotics (Chisholm and Hubert 1985, Mellas and Haynes 1985).

Fish with internal radio tags often die at higher rates than fish tagged by other means because radio tagging is a complicated and stressful process. Mortality is both acute (occurring during or soon after tagging) and delayed (occurring long after the fish have been released into the environment). Acute mortality is caused by trauma induced during capture, tagging, and release. It can be reduced by handling fish as gently as possible. Delayed mortality occurs if the tag or the tagging procedure harms the animal in direct or subtle ways. Tags may cause wounds that do not heal properly, may make swimming more difficult, or may make tagged animals more vulnerable to predation (Howe and Hoyt 1982, Matthews and Reavis 1990, Moring 1990). Tagging may also reduce fish growth by increasing the energetic costs of swimming and maintaining balance. As with the other forms of tagging and marking, researchers will keep the harm caused by radio tagging to a minimum by following the conditions given in the Description of the Proposed Actions section of this Opinion, as well as any other permit-specific requirements.

<u>Sacrifice</u>
In some instances, it is necessary to kill a captured fish in order to gather whatever data a study is designed to produce. In such cases, determining effect is a very straightforward process: the sacrificed fish, if juveniles, are forever removed from the ESU's gene pool; if the fish are adults, the effect depends upon whether they are killed before or after they have a chance to spawn. If they are killed after they spawn, there is very little overall effect. Essentially, it amounts to removing the nutrients their bodies would have provided to the spawning grounds. If they are killed before they spawn, not only are they removed from the ESU, but so are all their potential progeny. Thus, killing pre-spawning adults has the greatest potential to affect their ESU and, because of this, NOAA Fisheries rarely allows it to happen. And, in almost every instance where it is allowed, the adults are stripped of sperm and eggs so their

progeny can be raised in a controlled environment such as a hatchery—thereby greatly decreasing the potential harm posed by sacrificing the adults. Clearly, there is no way to mitigate the effects of outrightly sacrificing a fish.

**Permit-specific Effects**

The NWFSC releases a report annually that estimates outmigration numbers of juvenile salmon and steelhead for the Columbia River Basin. The estimates are generated from redd counts in tributary spawning areas, hatchery release estimates, fish collections at dams, and other observation points. The fish are categorized by ESU and whether they are natural or hatchery. NOAA Fisheries uses the estimates generated at Tongue Point because it is the location farthest downstream in the Columbia River Basin, thus, it is the most appropriate place given the ESUs addressed in this consultation.

| 2002 NWFSC smolt out-migration estimates to Tongue Point (NOAA Fisheries 2002a) | | | |
|---|---|---|---|
| Total wild listed steelhead | | LCR (12.00% of total) | |
| 1,915,421 | | 229,851 | |
| Total wild listed chinook salmon | | LCR (percent of total)<br>Fall 83.90%    Spring 48.29% | UWR (17.40% of total) |
| Total | 21,500,038 | 15,553,455 | 1,214,275 |
| Fall | 14,521,446 | 12,183,493 | |
| Spring | 6,978,592 | 3,369,962 | |
| Total wild chum salmon | | | |
| 330,480 | | | |

| 2001 Adult Escapement Estimates |
|---|
| LCR chinook salmon 10,000 (NOAA Fisheries 2000a) |
| UWR chinook salmon 2,523 |
| LCR steelhead 10,441 (McClure 2001) |
| CR chum salmon 851 (McClure 2001) |

<u>Permit 1135—Modification 1</u>
Permit 1135, modification 1, would authorize the USGS to annually capture up to 5,700 juvenile LCR steelhead in the Wind River Basin of southern Washington and kill up to 50 juvenile fish for isotope work and disease profiling. Up to 250 juvenile LCR steelhead may be killed indirectly during the course of the research. An unquantifiable number of adult and juvenile LCR steelhead would be observed via snorkeling during habitat surveys.

| Permit # | ESU | Capture/Handle/Release Adult | Juvenile | Indirect Mortality Adult | Juvenile | Sacrifice Adult | Juvenile |
|---|---|---|---|---|---|---|---|
| 1135 | LCR steelhead | | 5,700 | | 250 | | 50 |

For all fish not sacrificed during the study, the researchers will use all due care by anesthetizing fish before sampling and allowing them to recover in a holding tank before release. Fish not retained for isotope work or disease profiling would be returned to the stream at the point where they were captured.

Because the research will take place in the Wind River subbasin, the context for the effect is the juvenile LCR steelhead the system is expected to produce. WDFW estimated that 17,000 steelhead will outmigrate from Washington rivers upstream from Bonneville Dam to the Wind River (NOAA Fisheries 2002a). It is unknown exactly how many of these fish will reside in the Wind River when USGS conducts their research but we can assume that a large percentage of the 17,000 or more juvenile LCR steelhead will be in the system. The killing of up to 300 juvenile fish (5% of the total sample captured) would mean less than 2% reduction in the Wind River population. Placed in the context the entire ESU's outmigration, the effect of this loss on the Wind River population is low. This is especially true when the loss is placed in the context of the entire ESU's outmigration.

Even though the adverse effects associated with this research are low, the USGS will work to minimize them. USGS will adhere to NOAA Fisheries backpack electrofishing guidelines, they will coordinate with other agencies to avoid duplicating sampling efforts whenever possible, and they will anesthetize fish to mitigate the effects of handling stress.

<u>Permit 1322—Modification 1</u>

Permit 1322, modification 1, would authorize NWFSC to capture up to 451 juvenile LCR chinook salmon and 16 juvenile UWR chinook salmon and directly kill up to 400 juvenile CR chum salmon and 3 juvenile UWR chinook salmon in the Lower Columbia River estuary. An indirect mortality of 4 juvenile LCR chinook salmon is requested.

| Permit # | ESU | Capture/Handle/Release Adult | Juvenile | Indirect Mortality Adult | Juvenile | Sacrifice Adult | Juvenile |
|---|---|---|---|---|---|---|---|
| 1322 | LCR chinook | | 451 | | 4 | | |
| | CR chum | | | | | | 400 |
| | UWR chinook | | 16 | | | | 3 |

The study does not specifically target listed salmon, however it does target estuarine chinook, coho, and chum salmon in general, thus some of the take will be from listed stocks. Further, since the work is proposed to be conducted in the Columbia River estuary, other fish may also be encountered but will be released after sampling and recovery from anesthetic.

For all fish not sacrificed during the study, the researchers will use all due care by anesthetizing fish before sampling and allowing them to recover in a holding tank before release. Fish not lethally taken for tissue samples would be returned to the river at the point where they were captured.

Because the research will take place in the Columbia River estuary, all fish residing in and passing through may be subject to the sampling associated with this research. Therefore, determining the exact population of origin for most fish is impossible. NOAA Fisheries (2002a) estimates that 15,553,455 juvenile LCR chinook salmon, 330,480 juvenile CR chum salmon, and 1,214,275 juvenile UWR chinook salmon will pass Tongue Point in the lower Columbia River. The fish that may inadvertently die or will be sacrificed for this research constitutes much less than 0.01% of the juvenile LCR and UWR chinook salmon, and 0.12% of the juvenile CR chum salmon expected to outmigrate. Thus the modification to this permit is not expected to significantly affect the listed fish species that may be encountered.

Permit 1366

Permit 1366 would authorize the OSU to capture and tag up to 9 and directly kill up to 35 juvenile LCR chinook salmon associated with research to be conducted at Lower Granite Dam on the lower Snake River and McNary and Bonneville Dams on the lower Columbia River.

| Permit # | ESU | Capture/Handle/Release | | Indirect Mortality | | Sacrifice | |
|---|---|---|---|---|---|---|---|
| | | Adult | Juvenile | Adult | Juvenile | Adult | Juvenile |
| 1366 | LCR chinook | | 9 | | | | 35 |

The study does not specifically target listed salmon, however it is conducted at Lower Granite, McNary, and Bonneville Dams, thus some of the take will be from listed stocks.

Non-target fish will be immediately removed from the samples before anesthetization and placed back in area from which they were removed. Targeted fish not sacrificed will be handled carefully and will be anesthetized before sampling and allowed to recover in a holding tank before release.

Because the research will take place in the lower Snake and mainstem Columbia Rivers, all fish passing through the dams may be subject to the sampling associated with this research. Therefore, determining the exact population of origin for most fish is impossible. NOAA Fisheries (2002a) estimates that 15,553,455 juvenile LCR chinook salmon will pass Tongue Point in the lower Columbia River. The fish sacrificed for this research constitutes much less than 0.01% of the juvenile LCR chinook salmon expected to outmigrate. Thus the take associated with this research is not expected to significantly affect the listed fish species that may be encountered.

Nonetheless, even though the adverse effects associated with the research are very small, the OSU will work to minimize them even further by coordinating with other agencies to avoid duplicative efforts whenever possible.

Permit 1383

Permit 1383 would authorize the USGS to collect up to 2,225 juvenile LCR chinook salmon, 2,400 juvenile LCR steelhead, and 20 juvenile CR chum salmon in various streams and rivers in the states of

Oregon and Washington between Bonneville Dam and The Dalles Dam on the lower Columbia River. An indirect mortality of up to 111 juvenile LCR chinook salmon, 120 juvenile LCR steelhead, and 1 juvenile CR chum salmon is requested. An unquantifiable number of adult and juvenile LCR chinook salmon, LCR steelhead, and CR chum salmon would be observed via snorkeling to assess trout biomass and density and during habitat surveys.

| Permit # | ESU | Capture/Handle/Release | | Indirect Mortality | | Sacrifice | |
|---|---|---|---|---|---|---|---|
| | | Adult | Juvenile | Adult | Juvenile | Adult | Juvenile |
| 1383 | LCR chinook | | 2,225 | | 111 | | |
| | LCR steelhead | | 2,400 | | 120 | | |
| | CR chum | | 20 | | 1 | | |

The study does not specifically target listed salmonids, however it is conducted in locations where cutthroat trout and listed fish coexist. Even though the adverse effects associated with this research are low, the USGS will work to minimize them. USGS will adhere to NOAA Fisheries backpack electrofishing guidelines, coordinate with other agencies to avoid duplicating sampling efforts whenever possible, and anesthetize fish to mitigate the effects of handling stress.

Because the research will take place in a large number of streams in the lower Columbia River Basin, all fish in those areas may be subject to the sampling associated with this research. Therefore, determining the exact population of origin for the fish is impossible. NOAA Fisheries (2002a) estimates that 15,553,455 juvenile LCR chinook salmon, 229,851 juvenile LCR steelhead, and 330,480 juvenile CR chum salmon will pass Tongue Point in the lower Columbia River. The indirect mortality associated with this research constitutes much less than 0.01% of the juvenile LCR chinook salmon and CR chum salmon, and approximately 0.05% of the juvenile LCR steelhead expected to outmigrate. Thus the take associated with this research is not expected to significantly affect the listed fish species that may be encountered.

<u>Permit 1386</u>
Permit 1386 would authorize the WDOE to collect up to 10 adult and 50 juvenile LCR chinook salmon, LCR steelhead, and CR chum salmon in various streams and tributaries throughout the state of Washington. An indirect mortality of up to 1 juvenile LCR chinook salmon, 1 juvenile LCR steelhead, and 1 juvenile CR chum salmon each is requested.

| Permit # | ESU | Capture/Handle/Release | | Indirect Mortality | | Sacrifice | |
|---|---|---|---|---|---|---|---|
| | | Adult | Juvenile | Adult | Juvenile | Adult | Juvenile |
| 1386 | LCR chinook | 10 | 50 | | 1 | | |
| | LCR steelhead | 10 | 50 | | 1 | | |
| | CR chum | 10 | 50 | | 1 | | |

In all cases, ESA-listed fish are not targeted by this work and will be avoided whenever possible. If collected, ESA-listed fish will be immediately released in the location they were captured or held temporarily in an aerated live well to aid recovery.

Targeted (non-listed) fish will be captured using nets, seines, or electrofishing. Deployment, tending, and retrieval of nets will apply practices designed to minimize injury to captured fish. Electrofishing efforts will adhere to NOAA Fisheries and WDFW guidelines.

Because the research will take place in various streams and tributaries throughout the state of Washington, all fish in those areas may be subject to the sampling associated with this research. Therefore, determining the exact population of origin for the fish is impossible. NOAA Fisheries (2002a) estimates that 15,553,455 juvenile LCR chinook salmon, 229,851 juvenile LCR steelhead, and 330,480 juvenile CR chum salmon will pass Tongue Point in the lower Columbia River. Much of the sampling will occur upriver of this location thus more, and possibly many more juvenile fish may be present in those areas. The fish that may indirectly die as a result of this research constitutes much less than 0.01% of the juvenile listed fish expected to outmigrate. Thus the take associated with this research is not expected to significantly affect the listed fish species that may be encountered.

## Cumulative Effects

Cumulative effects include the effects of future state, tribal, local or private actions not involving Federal activities that are reasonably certain to occur within the action area subject to this consultation. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the Act.

State, Tribal and local government actions will likely to be in the form of legislation, administrative rules or policy initiatives. Government and private actions may include changes in land and water uses, including ownership and intensity, any of which could impact listed species or their habitat. Government actions are subject to political, legislative and fiscal uncertainties. These realities, added to the geographic scope of the action area which encompasses numerous government entities exercising various authorities and the many private landholdings, make any analysis of cumulative effects difficult and speculative.

Non-federal actions are likely to continue affecting the listed species. The cumulative effects in the action area are difficult to analyze considering the large geographic scope of this Opinion, the political variation in the action area, the uncertainties associated with government and private actions, and the changing economies of the region. Whether these effects will increase or decrease is a matter of speculation; however, based on the trends identified in this section, the adverse cumulative effects are likely to increase. Although state, Tribal and local governments have developed plans and initiatives to benefit listed fish, they must be applied and sustained in a comprehensive way before NOAA Fisheries can consider them “reasonably foreseeable” in its analysis of cumulative effects.

## Integration and Synthesis of Effect

<u>LCR chinook salmon</u>
The vast majority of the LCR chinook salmon (2,745 fish) that are requested to be captured, handled, tagged, etc., during the course of the proposed research are expected to survive with no long-term effects. All capture, handling, and holding methods will be minimally intrusive and of short duration. For those fish that do survive, it is difficult to show that the research has any long-term adverse effects at the individual level, let alone at the population or ESU level. Therefore, any adverse effects of the proposed research activities on the LCR chinook salmon are likely to be limited to lethal take alone.

**Maximum Annual Takes of Threatened Lower Columbia River Chinook Salmon**

| | Adult | | | | Juvenile | | | |
|---|---|---|---|---|---|---|---|---|
| Permit | HANDLE | | MORTALITY | | HANDLE | | MORTALITY | |
| Action | C,H,R | C,T/M,R | DIRECT | INDIRECT | C,H,R | C,T/M,R | DIRECT | INDIRECT |
| 1322 | | | | | 451 | | | 4 |
| 1366 | | | | | | 9 | 35 | |
| 1383 | | | | | 2,225 | | | 111 |
| 1386 | 10 | | | | 50 | | | 1 |
| TOTAL | 10 | | | | 2,726 | 9 | 35 | 116 |

KEY: C,H,R = Capture, Handle, Release; C,T/M,R = Capture, Tag/Mark, Release

If the total amount of estimated lethal take for all research activities—151 juvenile LCR chinook salmon—is expressed as a fraction of the 15,553,455 fish expected to reach Tongue Point, it represents a loss of less than 0.001% of the run. However, and for a number of reasons, that number is in actuality probably much smaller. It is important to remember the fact that every estimate of lethal take for the proposed studies has purposefully been inflated and it is therefore very likely that fewer than 151 juveniles will be killed by the research—possibly many fewer. Some of the studies will specifically affect LCR chinook salmon in the smolt stage, but others will not. These latter studies are described as affecting "juveniles," which means they may target chinook salmon yearlings, parr, or even fry: life stages represented by many more individuals than reach the smolt stage—perhaps as much as an order of magnitude more. Therefore the 0.001% figure was derived by (a) overestimating the number of fish likely to be killed, and (b) treating each dead LCR chinook salmon as a smolt when some of them clearly won't be. Thus the actual number of LCR chinook salmon the research is likely to kill is undoubtedly smaller than 0.001%—perhaps as little as half (or less) of that figure. The loss of a smolt is not equivalent to the loss of an adult in terms of species survival and recovery. This is due to the fact that a great many smolts die before they can mature into adults. Typically only 1-12% of the outmigrating smolts survived to return as adults. This indicates that (conservatively) something near 90% of the smolts leaving the Lower Columbia River do not survive to return as adults. If this number holds even approximately true for the ESU as a whole, it means that some 90% of the 0.001% figure would likely be killed during the natural course of events. Even if the entire 151 juvenile LCR chinook salmon are killed, it is very difficult to translate that number into an actual effect on the species. Therefore, the adverse effect such a loss would have on the ESU is negligible at most.

LCR steelhead

The vast majority of the LCR steelhead (8,160 fish) that are requested to be captured, handled, tagged, etc., during the course of the proposed research are expected to survive with no long-term effects. All capture, handling, and holding methods will be minimally intrusive and of short duration. For those fish that do survive, it is difficult to show that the research has any long-term adverse effects at the individual level, let alone the population or ESU level. Therefore, any adverse effects of the proposed research activities on the LCR steelhead are likely to be limited to lethal take alone.

**Maximum Annual Takes of Threatened Lower Columbia River Steelhead**

| | Adult | | | | Juvenile | | | |
|---|---|---|---|---|---|---|---|---|
| Permit | HANDLE | | MORTALITY | | HANDLE | | MORTALITY | |
| Action | C,H,R | C,T/M,R | DIRECT | INDIRECT | C,H,R | C,T/M,R | DIRECT | INDIRECT |
| 1135 | | | | | | 5,700 | 50 | 250 |
| 1383 | | | | | 2,400 | | | 120 |
| 1383 | 10 | | | | 50 | | | 1 |
| TOTAL | 10 | | | | 2,450 | 5,700 | 50 | 371 |

KEY: C,H,R = Capture, Handle, Release; C,T/M,R = Capture, Tag/Mark, Release

If the total amount of estimated lethal take for all research activities—421 juvenile LCR steelhead—is expressed as a fraction of the 229,851 fish expected to reach Tongue Point, it represents a loss of approximately 0.18% of the run. However, and for a number of reasons, that number is in actuality probably much smaller. It is important to remember the fact that every estimate of lethal take for the proposed studies has purposefully been inflated and it is therefore very likely that fewer than 421 juveniles will be killed by the research—possibly many fewer. Some of the studies will specifically affect LCR steelhead in the smolt stage, but others will not. These latter studies are described as affecting "juveniles," which means they may target steelhead yearlings, parr, or even fry: life stages represented by many more individuals than reach the smolt stage—perhaps as much as an order of magnitude more. Therefore the 0.18% figure was derived by (a) overestimating the number of fish likely to be killed, and (b) treating each dead LCR steelhead as a smolt when some of them clearly won't be. Thus the actual number of LCR steelhead the research is likely to kill is undoubtedly smaller than 0.18%—perhaps as little as half (or less) of that figure. The loss of a smolt is not equivalent to the loss of an adult in terms of species survival and recovery. This is due to the fact that a great many smolts die before they can mature into adults. Typically only 1-12% of the outmigrating smolts survived to return as adults. This indicates that (conservatively) something near 90% of the smolts leaving the Columbia River do not survive to return as adults. If this number holds even approximately true for the ESU as a whole, it means that some 90% of the 0.18% figure would likely be killed during the natural course of events. Even if the entire 421 juvenile LCR steelhead are killed, it is very difficult to translate that number into an actual effect on the species. Therefore, the adverse effect such a loss would have on the ESU is negligible at most.

<u>CR chum salmon</u>
The vast majority of the CR chum salmon (80 fish) that are requested to be captured, handled, and released during the course of the proposed research are expected to survive with no long-term effects. All capture, handling, and holding methods will be minimally intrusive and of short duration. For those fish that do survive, it is difficult to show that the research has any long-term adverse effects at the individual level, let alone the population or ESU level. Therefore, any adverse effects of the proposed research activities on the CR chum salmon are likely to be limited to lethal take alone.

**Maximum Annual Takes of Threatened Columbia River Chum Salmon**

| | Adult | | | | Juvenile | | | |
|---|---|---|---|---|---|---|---|---|
| Permit | HANDLE | | MORTALITY | | HANDLE | | MORTALITY | |
| Action | C,H,R | C,T/M,R | DIRECT | INDIRECT | C,H,R | C,T/M,R | DIRECT | INDIRECT |
| 1322 | | | | | | | 400 | |
| 1383 | | | | | 20 | | | 1 |
| 1386 | 10 | | | | 50 | | | 1 |
| TOTAL | 10 | | | | 70 | | 400 | 2 |

KEY: C,H,R = Capture, Handle, Release; C,T/M,R = Capture, Tag/Mark, Release

If the total amount of estimated lethal take for all research activities—402 juvenile CR chum salmon—is expressed as a fraction of the 330,480 fish expected to reach Tongue Point, it represents a loss of approximately 0.12% of the run. It is important to remember the fact that every estimate of lethal take for the proposed studies has purposefully been inflated and it is therefore very likely that fewer than 402 juveniles will be killed by the research. The loss of a juvenile fish is not equivalent to the loss of an adult in terms of species survival and recovery. This is due to the fact that a great many juvenile fish die before they can mature into adults. Typically only 1-12% of the outmigrating smolts survived to return as adults. This indicates that (conservatively) something near 90% of the smolts leaving the Columbia River do not survive to return as adults. If this number holds even approximately true for the ESU as a whole, it means that some 90% of the 0.12% figure would likely be killed during the natural course of events. Even if the entire 402 juvenile CR chum salmon are killed, it is very difficult to translate that number into an actual effect on the species. Therefore, the adverse effect such a loss would have on the ESU is negligible at most.

UWR chinook salmon

The vast majority of the UWR chinook salmon (16 juvenile fish) that are requested to be captured, handled, and released during the course of the proposed research are expected to survive with no long-term effects. The handling will be conducted in such a way as to minimize any effects to fish released. Three juvenile fish are requested to be killed but because this is such a low number compared to the expected abundance, any long-term adverse effects at the population or ESU level is expected to be minimal.

**Maximum Annual Takes of Threatened Upper Willamette River Chinook Salmon**

| | Adult | | | | Juvenile | | | |
|---|---|---|---|---|---|---|---|---|
| Permit | HANDLE | | MORTALITY | | HANDLE | | MORTALITY | |
| Action | C,H,R | C,T/M,R | DIRECT | INDIRECT | C,H,R | C,T/M,R | DIRECT | INDIRECT |
| 1322 | | | | | 16 | | 3 | |

KEY: C,H,R = Capture, Handle, Release; C,T/M,R = Capture, Tag/Mark, Release

If the total amount of estimated juvenile lethal take for all research activities on UWR chinook salmon (3 fish) is expressed as a percentage of the 1,214,275 fish expected to reach Tongue Point, it represents a loss of much less than one tenth of one percent of the run.

The loss of a smolt is not equivalent to the loss of an adult in terms of species survival and recovery. This is due to the fact that a great many smolts die before they can mature into adults. Typically only 1-12% of the outmigrating smolts survived to return as adults. This indicates that (conservatively) something near 90% of the smolts leaving the Willamette River do not survive to return as adults. If this number holds even approximately true for the ESU as a whole, it means that some 90% of the very small number would likely be killed during the natural course of events.

Nonetheless, regardless of its magnitude, that negative effect must be juxtaposed with the benefits to be derived from the research (see descriptions of the individual permits). Those benefits range from finding ways to improve salmonid survival through the Columbia River Hydropower System (Permit 1366) to determining population status in a single river basin (Permit 1135). In all, the fish will derive some benefit from every permit considered in this Opinion. The amount of benefit will vary, but in some cases it may be significant. Therefore, in deciding whether to issue the permits considered here, NOAA Fisheries must compare the tangible benefits they will produce (some of which are potentially significant) with the certainly negligible adverse effects they will cause. Moreover, NOAA Fisheries must weigh similar factors (benefit versus adverse effect) when deciding whether the contemplated actions will appreciably reduce the likelihood of survival and recovery for each of the ESUs covered under this document—the critical determination in issuing any biological opinion.

**Conclusions**

After reviewing the current status of the threatened ESUs under consultation, the environmental baseline for the action area, the effects of the proposed section 10(a)(1)(A) permit actions, and cumulative effects, it is NOAA Fisheries' biological opinion that issuance of the proposed permits is not likely to jeopardize the continued existence of the threatened ESUs under consultation.

**Coordination with the National Ocean Service**

The activities contemplated in this Opinion will not be conducted in or near a National Marine Sanctuary. Therefore, these activities will not have an adverse effect on any National Marine Sanctuary.

**Reinitiation of Consultation**

Consultation must be reinitiated if: The amount or extent of annual takes specified in the permits is exceeded or is expected to be exceeded; new information reveals effects of the actions that may affect the ESA-listed species in a way not previously considered; a specific action is modified in a way that causes an effect on the ESA-listed species that was not previously considered; or a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16).

## MAGNUSON-STEVENS ACT ESSENTIAL FISH HABITAT CONSULTATION

"Essential fish habitat" (EFH) is defined in section 3 of the Magnuson-Stevens Act (MSA) as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." NOAA Fisheries interprets EFH to include aquatic areas and their associated physical, chemical and biological properties used by fish that are necessary to support a sustainable fishery and the contribution of the managed species to a healthy ecosystem.

The MSA and its implementing regulations at 50 CFR 600.920 require a Federal agency to consult with NOAA Fisheries before it authorizes, funds or carries out any action that may adversely effect EFH. The purpose of consultation is to develop a conservation recommendation(s) that addresses all reasonably foreseeable adverse effects to EFH. Further, the action agency must provide a detailed, written response NOAA Fisheries within 30 days after receiving an EFH conservation recommendation. The response must include measures proposed by the agency to avoid, minimize, mitigate, or offset the impact of the activity on EFH. If the response is inconsistent with NOAA Fisheries' conservation recommendation the agency must explain its reasons for not following the recommendations.

The objective of this consultation is to determine whether the proposed actions, the funding and issuance of scientific research permits under section 10(a)(1)(A) of the ESA for activities within the states of Oregon and Washington, is likely to adversely affect EFH. If the proposed actions are likely to adversely affect EFH, a conservation recommendation(s) will be provided.

### Identification of Essential Fish Habitat

The Pacific Fishery Management Council (PFMC) is one of eight Regional Fishery Management Councils established under the Magnuson-Stevens Act. The PFMC develops and carries out fisheries management plans for Pacific coast groundfish, coastal pelagic species and salmon off the coasts of Washington, Oregon, and California. Pursuant to the MSA, the PFMC has designated freshwater and marine EFH for Pacific salmon; it includes all those streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to salmon in Washington, Oregon, Idaho, and California, except upstream of certain impassable man-made barriers (as identified by the PFMC), and longstanding, naturally-impassable man-made barriers (i.e., natural waterfalls in existence for several hundred years)(PFMC 1999). Marine EFH for Pacific salmon in Oregon and Washington includes all estuarine, nearshore and marine waters within the western boundary of the U.S. Exclusive Economic Zone, 200 miles offshore.

### Proposed Action and Action Area

For this EFH consultation the proposed actions and action areas are as described in detail in the ESA consultation above. The actions are the funding and issuance of a number of scientific research permits pursuant to section 10(a)(1)(A) of the ESA. The proposed action area is the Columbia River Basin, including the Willamette River subbasin. A more detailed description and identification of EFH for salmon is found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). Assessment of the impacts to these species' EFH from the above proposed action is based on this information.

**Effects of the Proposed Action**

Based on information submitted by the action agencies and permit applicants, as well as NOAA Fisheries' analysis in the ESA consultation above, NOAA Fisheries believes that the effects of this action on EFH are likely to be within the range of effects considered in the ESA portion of this consultation.

**Conclusion**

Using the best scientific information available and based on its ESA consultation above, as well as the foregoing EFH sections, NOAA Fisheries has determined that the proposed actions are not likely to adversely affect Pacific salmon EFH.

**EFH Conservation Recommendation**

NOAA Fisheries has no conservation recommendations to make in this instance.

**Consultation Renewal**

The action agencies must reinitiate EFH consultation if plans for these actions are substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for the EFH conservation recommendations (50 CFR Section 600.920(k)).

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